Sexual dimorphism in the head size of the Little Brown Skink *Scincella lateralis*

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ABSTRACT

Abstract.– Many species of skinks, a common type of lizard, show pronounced sexual dimorphism in that males have larger heads for their size than females. This can occur in species in which males have greater body length and show different coloration than females, such as several species of the North American genus *Plestiodon*, but can also occur in species in which males and females have the same body length, or even in species in which females are larger. Another North American skink species, *Scincella lateralis*, does not exhibit obvious sexual dimorphism in head size. However, behavioral data suggest sexual differences in head size might be expected since male *S. lateralis* are more aggressive than females and aggressive interactions often involve biting. In this study, we measured snout-to-vent length and head dimensions of a 31 male and 35 female *S. lateralis* from northeastern Oklahoma. Females were slightly larger than males, but males had longer, wider, and deeper heads for their size than females. Sexual dimorphism in head size may be the result of sexual selection favoring larger heads in males to help them win contests with other males. However, male *S. lateralis* are also aggressive to females and larger male head size may give males an advantage in contests with females whose body sizes are equal to or larger than theirs.

INTRODUCTION

Sexual dimorphism is physical differences between males and females. A good example of this in a lizard species found in Oklahoma in the Common Five-Lined Skink, *Plestiodon fasciatus* in which adult males have orange colored heads that are wider and longer compared to the smaller striped head of adult females (Figure 1). In the worldwide family of skinks (Scincidae), such sexual dimorphisms are common; both in species in which males are larger than females (Olsson et al 2002; Heideman et al 2008), and in species in which males and females are the same size (Schwarzkopf 2005; Heideman et al 2008). There are even a few cases in which males have larger heads than females even though females have larger body size (Bull and Pamula 1996; Ji and Du 2000). Such differences are often due to sexual selection that favors traits in males that help them win in competition with other males and/or to attract females (Hickman *et al*, 2006). In many other lizards, these types of dimorphisms are not as apparent, as is the case with another Oklahoma species, the Little Brown Skink *Scincella lateralis* in which there are no obvious head size or color pattern differences between the sexes (Figure 2). However, behavioral studies have shown that male *S. lateralis* tend to be more aggressive than females in both intra- and inter-sexual encounters (Akin, 1997) and that there are significant difference in the dentition pattern (Townsend et al., 1999). Since aggressive interactions involve biting, it is possible male *S. lateralis* may have evolved larger head sizes due to sexual selection. In this study, we measured head dimensions of males and female *S. lateralis* to determine whether or not there is a significant difference in the head size.

Figure 1. An adult male an and adult female *Plestiodon fasciatus*. The bar is approximately 1 cm.

Figure 2. An adult *Scincella lateralis* (sex unknown: males and females have the same coloration)

MATERIALS and METHODS

A total of 31 male *S. lateralis* and 35 female *S. lateralis* were captured from Sparrowhawk Primitive Area in Cherokee county, Oklahoma from May to August 2009, 2010, and 2011. Sex was confirmed by eversion of hemipenes of males. The snout-to-vent (SVL) lengths were measured in millimeters and weights were taken in grams. Head dimensions length, width, and depth, were measured to the nearest 0.001 mm using a pair of digital calipers. The length was measured from the tip of the snout to the anterior edge of the tympanum. The width was measured at the level of the hinge of the jaw. The depth was measured from the parietal scale at top of the head to the throat (again and the level of the hinge of the jaw). Care was taken as to not indent the softer tissues of the head when using the calipers. All measurements were taken before sex was determined to avoid bias.

We statistically compared males to females using t-tests. Because females were larger than males (see Results), we used Analysis of Co-Variance (ANCOVA) of log-transformed variables using sex as the factor being tested and the log of SVL as the covariate to evaluate differences in head dimensions between the sexes. ANCOVAs were run separately for log-transformed Head Length, Head Width, and Head Depth dimensions. Initial ANCOVAs were run to check for a significant difference between the sexes in the slopes of the lines relating each head size variable to SVL by checking for a significant sex X log of SVL interaction (Schwarzkopf 2005). If there was no significant sex X log of SVL interaction, the interaction term was eliminated and the ANCOVAs run again to determine if there was a difference in the intercepts of the linear regressions of males versus females. Such a difference indicates that one sex is significantly larger for its size in that head dimension than the other sex (Sokal and Rohlf 1995; Schwarzkopf 2005). All statistics were run using MYSTAT 12 (Systat Software Inc., Chicago, Illinois, USA) or IBM SPSS Statistics 19 (SPSS, Inc., Armonk, New York, USA).

RESULTS

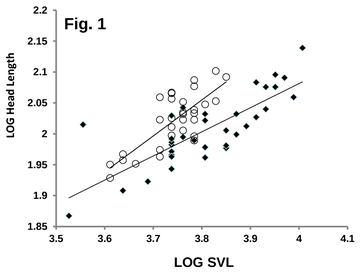
Overall, the female Little Brown Skinks were larger than the males (Table 1: SVL), but there was no difference in mean length, width, or depth of head.

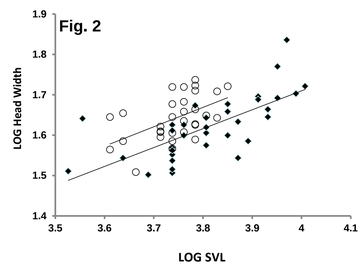
TABLE 1. Mean ± SD of size and head measurements for male and female *Scincella lateralis*. The *P* value is for a t-test comparing males to females; "ns"= not statistically significant. Sample size is given in parentheses.

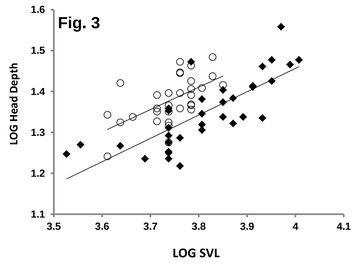
	Males (N = 31)	Females (N = 35)	*P* of t-test
SVL (mm)	**42.3 ± 2.52**	**45.5 ± 5.09**	**0.001**
Head Length (mm)	7.56 ± 0.344	7.46 ± 0.424	0.285 ns
Head Width (mm)	5.17 ± 0.288	5.09 ± 0.400	0.274 ns
Head Depth (mm)	3.98 ± 0.223	3.87 ± 0.337	0.121 ns

ANCOVA of log-transformed variables using the log of SVL as the covariate revealed no significant differences between males and females in the slopes of the lines relating head size dimension to SVL for any of the three head dimensions, though the results for Head Length narrowly failed to reach statistical significance (Head Length: $F = 3.110$, df = 1,61, $P = 0.083$, Fig. 1; Head Width: $F = 0.005$, df = 1, 61, $P = 0.945$, Fig. 2; Head Depth: $F = 0.020$, df = 1,61, $P = 0.889$, Fig 3). However, when the ANCOVAs were re-run with the sex X log of SVL interaction term deleted, males heads were found to be significantly larger than female heads for all three head dimensions (Head Length: $F = 24.659$, df = 1, 62, $P < 0.001$, Fig. 1; Head Width: $F = 14.414$, df = 1, 62, $P < 0.001$, Fig. 2; Head Depth: $F = 26.440$, df =1, 62, P < 0.001, Fig. 3). These results indicate that for a given SVL, male Little Brown Skinks have longer, wider, and deeper heads than female Little Brown Skinks (Figures 1–3).

FIGURES 1-3. Relationship between (1) Log of Head Length; (2) Log of Head Width; and (3) Log of Head Depth to Log of SVL in adult male and female *Scincella lateralis*. Open circles are males, closed diamonds are females. The linear regression lines from males (upper line) and females (lower line) are shown. There is no significant difference between the slopes of the lines (though the difference narrowly fails to reach statistical significance for Head length), but there is a significant difference in the intercepts for all three measures indicating males have longer, wider, and deeper heads for their size than females.







DISCUSSION

The results show male Little Brown Skinks have larger heads for their size than do females confirming that sexual dimorphism occurs in this species. The differences may be due to selection favoring males having larger muscles and bones in the head to aid in competitive interactions with other lizards. This may be due to males competing with other males for access to females, or may be due to males competing with equally sized or larger females for access to food or other resources (Akin 1997).

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